Minimum Wage Policy and Community College Enrollment Patterns

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Supplemental Online Appendix

Additional Robustness Checks

Spillover of Minimum Wage Policy

As discussed in the Empirical Strategy section of the article, misalignment between the place of work and residence has the potential to attenuate the estimates reported in Tables 3 and 4. Under the assumption that the likelihood of cross-border commuting decreases as the distance from the border increases, omitting the schools closest to the border from the sample reduces the number of individuals who study and work in different states. Creating a sample of schools in the "donut-shaped" area around the boundary produces estimates more robust to the attenuation bias. To conduct this test, I apply the main specification to the sample excluding the schools closest to the state borders. Note, however, that this restriction has the potential to exacerbate the bias from the spatially correlated time-varying local characteristics because schools in each pair are located farther away from one another on average. The paired schools are therefore more likely to be exposed to dissimilar sets of unobservables.

The results are presented in Table B.1. Under the restriction that schools must be at least 15 kilometers (9.3 miles) away from the borders and paired with a school in another state located within a 100 kilometer (62.1 mile) radius, a 10% increase in the minimum wage reduces the total and part-time enrollments by 5.2% and 7.7%, respectively. Although the estimates fluctuate slightly based on the sample restriction, they remain negative and significant across all columns. The greater magnitude observed in three of the estimates relative to the main results for the total enrollments and in all four estimates for the part-time enrollments suggests that cross-border commuting has the potential to attenuate the estimates.

Opening and Closing of Community Colleges

Although it is unlikely that the opening or closing of a community college affects the results, as community colleges rarely open or close, there may be concerns of correlation between the changes in the number of community colleges in the vicinity causing a bias in the estimates. To investigate, additional regressions test whether an increase in the minimum wage is correlated with the number of in-state schools within the X kilometer radius of each school in the sample. The econometric specification follows the pair-by-year FE model, and the estimate captures the effect of a minimum wage change on the number of schools on either side of the policy discontinuity.

The results are presented in Table B.2. Each column contains the estimates obtained with a different radius used to generate the outcome variable. The estimates remain insignificant and close to zero. Column (3) implies that when the minimum wage increases by 10% on one side of the border, the number of schools within 120 kilometers (74.6 miles) of the community college directly affected by a change in the minimum wage rises insignificantly by 0.065. As a 10% increase is a sizable change in the minimum wage, the correlation between the minimum wage and the number of in-state schools appears to be small and irrelevant in the identification of the relationship between the minimum wage and community college enrollment patterns.

Sample Restrictions and Pairing Methods

Table B.3 presents the estimates obtained from the additional analyses testing the robustness of the main results with a focus on the sample selection. In column (1), an alternative pairing method is used to ensure that the schools in each pair are located in similar communities in addition to being in proximity. Specifically, each school is classified urban, suburban, or rural based on its urban-centric locale code, and a pair is formed only if the locale codes of the schools match.[1] In column (2), whether the results are driven by the over-representation of the schools with more than one match is tested by randomly eliminating the copies of duplicate observations until each school appears in the sample once a year.[2] In columns (3) and (4), the school-level covariates are excluded to make sure that the results are not driven by the selection of schools consistently reporting these characteristics. In column (4), the panel is fully balanced by restricting the sample to the schools with 21 years of observations. In column (5), the schools in the New England region are excluded to test whether the estimates are robust to omitting the region with the highest school density.[3] In column (6), the observations made during the Great Recession are omitted to ensure that the effect is not driven by concurrence of high unemployment rates and minimum wage hikes during this time period. Across all columns of Table B.3, the elasticities remain negative and significant for the total and part-time enrollment outcome variables, showing that the main results are robust to various alterations of the paired sample.

Employment and School Enrollment Patterns

Minimum wage clearly affects community college enrollment patterns according to the main results. In addition, the article finds that trade schools are unlikely to be credible alternatives for community college students leaving school when minimum wage rises. Therefore, the factors

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[1] The National Center for Education Statistics (NCES) uses urban-centric locale categories to define the urbanization of the surrounding area for each school. The categorization is based on the size of the population in the metropolitan area and the location of each locale relative to the closest urban center. Twelve sub-categories can be consolidated into four: city, suburb, town, and rural. In this analysis, town is merged with rural for simplicity.

[2] Alternatively, it is possible to down-weight each pair by inverse of frequency with which a school is included. Such down-weighting does not change the results.

[3] Excluding other divisions or regions does not cause a significant change in the estimates. The results are available on request.

related to the labor market are likely drivers of the observed enrollment loss. Potentially, many channels can affect which labor market changes induced by an increase in minimum wage can influence an individual's decision to enroll. Of the potential channels, I focus on two channels most directly related to employment and wages: 1) the substitution effect from rising opportunity costs of education incentivizes potential students to focus on work and 2) the loss of employment opportunities reduces affordability of education.

The Integrated Postsecondary Education Data System (IPEDS) lacks two necessary pieces of information for this analysis. First, the IPEDS does not include any data on individuals who choose not to enroll. Second, the IPEDS does not contain information on the employment status of students. A further analysis studying the choice between employment and education, then, requires individual-level data sets with work and education histories.

An ideal data set for this analysis is a panel of individuals with sub-state local identifiers with information on employment and school attendance. If such a data set were available, the channels could be studied by dividing the sample into groups characterized by their work history and estimating the effect of a minimum wage change on school enrollment patterns of each group. If individuals with a continuous employment history exhibit a reduction in enrollment as the minimum wage rises, an implication is that the negative relationship between minimum wage and community college enrollment is driven by workers responding to higher wages by reducing their investment in education. Conversely, if individuals who became recently unemployed choose to leave school, the reduction in enrollment may be driven by affordability of postsecondary education.

While the ideal data set does not exist, the American Community Survey (ACS) serves as a close alternative. The ACS is an annual cross-sectional sample of the US population. The strength of the ACS comes from the size of the sample and the richness of sub-state geographic identifiers. In this analysis, I use the Public Use Microdata Areas (PUMAs) to link the individuals in the ACS to community colleges in the sample of paired community colleges. Then, the sample is restricted to individuals living in these PUMAs aged less than 40 with educational attainment between high school diploma and a diploma or certificate from a two-year institution. The restricted sample contains potential community college students living in the PUMAs where community colleges appearing in the main sample are located.

As the data set contains observations from a different cross-section each year, it is not possible to link individuals across time. However, the ACS contains information on the individual's employment status within the past 12 months. Using this information, individuals are grouped into four categories based on their employment histories. The consistently employed are currently employed and employed at least 50 weeks last year; the recently employed are currently employed and employed less than 50 weeks last year; the recently unemployed are currently unemployed and employed at least 1 week last year; the consistently unemployed are currently unemployed and unemployed last year.

To test which of the groups exhibit reduction in school attendance, I construct an econometric model of the following form:

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\begin{aligned}
school_{imt} = \beta_0 + \beta_1 \log(mw_{mt}) + \beta_2 CU_{imt} + \beta_3 RU_{imt} + \beta_4 RE_{imt} + \beta_5 \log(mw_{mt}) \times CU_{imt} \\
+ \beta_6 \log(mw_{mt}) \times RU_{imt} + \beta_7 \log(mw_{mt}) \times RE_{imt} + \gamma X_{mt} + \varphi_t + \varphi_m + \varepsilon_{imt}
\end{aligned}
$$

where the outcome variable $school_{imt}$ is an indicator taking a value of 1 if an individual *i* living in PUMA *m* on year *t* is currently enrolled at school. The employment history indicators are denoted CU, RU, and RE for the consistently unemployed, recently unemployed, and recently employed, respectively. The omitted category is the consistently employed. The regression includes the state-level covariates from the main regression as well as PUMA and year fixed effects. Estimates are unbiased under the assumptions that the sample from each PUMA remains representative of the population and the minimum wages and composition of population in each PUMA are exogenously determined. Clearly this second condition is unlikely to be satisfied, and the estimated coefficients do not necessarily represent a causal relationship. Note that the exact date of survey for each individual is unavailable. Any estimate therefore must be interpreted as the local average effect of an increase in the minimum wages sometime within last 24 months.

The results are presented in Table B.4. A 10% increase in minimum wage is associated with a 0.34 percentage point decrease in the probability of attending school among the consistently employed individuals. More important, the individuals with a consistent history of employment are much more likely to respond to a minimum wage increase by reducing school attendance relative to the individuals in other groups. If the restricted sample in the ACS represents the individuals most likely to attend community colleges in the paired-school sample, the results in Table B.4 suggest that a reduction in enrollment observed in the main analysis may be driven by individuals with a stable spell of employment before and after a minimum wage change.

In addition, I use the same data set to analyze whether the attendance effect of a minimum wage increase depends on current employment status. According to Table B.5, part-time workers is the only group to exhibit a reduction in school attendance. Full-time workers do not respond to a minimum wage change at all, and those without employment appear to increase school attendance.

Table B.1. Schools near State Boundaries Excluded

Distance to border	At least 15 km away		At least 10 km away	
Maximum distance within pair	100 km	120 km	100 km	120 km
Dependent variable				
Log(Total enrollment)	–0.516***	–0.462***	–0.544***	–0.520***
	(0.149)	(0.159)	(0.150)	(0.150)
Log(F/T enrollment)	–0.183	–0.256	–0.213	–0.282*
	(0.143)	(0.143)	(0.145)	(0.148)
Log(P/T enrollment)	–0.774***	–0.652***	–0.754***	–0.672***
	(0.205)	(0.213)	(0.188)	(0.185)
Number of schools	113	147	183	223
Observations	3,136	4,234	5,270	6,618

Notes: Data from the Integrated Postsecondary Education Data System (IPEDS), US Census Bureau population estimates, and the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data from 1990 to 2010. Minimum wage data collected by the author and cross-checked with other publications. All specifications include state-level characteristics (proportion of population receiving Aid to Families with Dependent Children [AFDC] and Supplemental Nutrition Assistance Program [SNAP], poverty rate, log of the median income, an indicator for a Democratic governor, and the proportion of the seats held by Democrats in the state house and senate), school-level characteristics (number of in-state community colleges within 120 km radius, number of out-of-state community colleges within 120 km radius, fees and tuition paid by in-district full-time students, and fees and tuition paid by out-of-state full-time students), estimated population of each county's residents aged 15 to 29, gender and racial composition of each county, school fixed effects, and pair-by-year fixed effects. Standard errors in parentheses are clustered at the cluster-group level, and the critical values are generated using the wild bootstrap procedure. F/T, full-time; P/T, part-time.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B.2. School Openings and Closures

Dependent variable	Number of schools		
Radius	40 km	80 km	120 km
Log(MW)	–0.004	0.239	0.648
	(0.121)	(0.434)	(0.456)
Number of schools	284	284	284
Observations	8,112	8,112	8,112

Notes: Data from the Integrated Postsecondary Education Data System (IPEDS), US Census Bureau population estimates, and the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data from 1990 to 2010. Minimum wage data collected by the author and cross-checked with other publications. All specifications include state-level characteristics (proportion of population receiving Aid to Families with Dependent Children [AFDC] and Supplemental Nutrition Assistance Program [SNAP], poverty rate, log of the median income, an indicator for a Democratic governor, and the proportion of the seats held by Democrats in the state house and senate), school-level characteristics (number of in-state community colleges within 120 km radius, number of out-of-state community colleges within 120 km radius, fees and tuition paid by in-district full-time students, and fees and tuition paid by out-of-state full-time students), estimated population of each county's residents aged 15 to 29, gender and racial composition of each county, school fixed effects, and pair-by-year fixed effects. Standard errors in parentheses are clustered at the cluster-group level. MW, minimum wage.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B.3. Robustness Checks

Maximum distance	100 km					
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable						
Log(Total enrollment)	–0.502***	–0.454**	–0.518**	–0.589***	–0.331**	–0.411**
	(0.170)	(0.184)	(0.189)	(0.200)	(0.153)	(0.174)
Log(F/T enrollment)	–0.093	–0.115	–0.294*	–0.315*	–0.265	–0.134
	(0.123)	(0.196)	(0.152)	(0.162)	(0.156)	(0.146)
Log(P/T enrollment)	–0.743***	–0.618**	–0.592**	–0.635**	–0.454*	–0.526*
	(0.224)	(0.258)	(0.259)	(0.262)	(0.260)	(0.258)
Locale match	✓					
Unique matches		✓				
No school-level covariates			✓	✓		
Fully balanced				✓		
Northeast omitted					✓	
Great Recession omitted						✓
Number of schools	217	172	290	242	240	284
Observations	5,996	3,372	8,412	7,476	6,760	6,872

Notes: Data from the Integrated Postsecondary Education Data System (IPEDS), US Census Bureau population estimates, and the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data from 1990 to 2010. Minimum wage data collected by the author and cross-checked with other publications. All specifications include state-level characteristics (proportion of population receiving Aid to Families with Dependent Children [AFDC] and Supplemental Nutrition Assistance Program [SNAP], poverty rate, log of the median income, an indicator for a Democratic governor, and the proportion of the seats held by Democrats in the state house and senate), school-level characteristics (number of in-state community colleges within 120 km radius, number of out-of-state community colleges within 120 km radius, fees and tuition paid by in-district full-time students, and fees and tuition paid by out-of-state full-time students), estimated population of each county's residents aged 15 to 29, gender and racial composition of each county, school fixed effects, and pair-by-year fixed effects. Standard errors in parentheses are clustered at the cluster-group level. F/T, full-time; P/T, part-time.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B.4. ACS: Employment History

Dependent variable	P(School enrollment)
Log(MW)	–0.036*
	(0.020)
CU	–0.053
	(0.049)
RU	–0.036
	(0.068)
RE	–0.150**
	(0.056)
CU × Log(MW)	0.056**
	(0.025)
RU × Log(MW)	0.073**
	(0.035)
RE × Log(MW)	0.106***
	(0.029)
Mean of dependent variable among the omitted group	0.163
PUMAs	261
Observations	347,119

Notes: Main sample is from the American Community Survey (ACS) over the years 2005 to 2011. Sample is restricted to the community-college-eligible residents of PUMAs with community colleges in the paired sample who have continuously lived in their state of residence for at least 12 months at the time of the survey. Covariates are constructed using the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data. Minimum wage data collected by the author and cross-checked with other publications. All specifications include state-level characteristics (proportion of Aid to Families with Dependent Children [AFDC] and Supplemental Nutrition Assistance Program [SNAP] recipients, poverty rate, an indicator for a Democratic governor, and the proportion of Democrats in state house and senate), demographic controls (gender, age, age squared), year fixed effects, and PUMA fixed effects. Standard errors in parentheses are clustered at the state level, and the critical values are generated using the wild bootstrap procedure. CU, consistently unemployed; MW, minimum wage; PUMAs, Public Use Microdata Areas; RE, recently employed; RU, recently unemployed.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table B.5. ACS: Current Employment

Dependent variable	P(School enrollment)
Log(MW)	–0.044*
	(0.025)
Log(MW) × Full-time	0.050*
	(0.025)
Log(MW) × Unemployed	0.101***
	(0.034)
Full-time	–0.278***
	(0.048)
Unemployed	–0.289***
	(0.066)
PUMAs	261
Observations	347,119

Notes: Main sample is from the American Community Survey (ACS) over the years 2005 to 2011. Sample is restricted to community-college-eligible residents of PUMAs with community colleges in the paired sample who have continuously lived in their state of residence for at least 12 months at the time of the survey. Covariates are constructed using the University of Kentucky Center for Poverty Research (UKCPR) National Welfare Data. Minimum wage data collected by the author and cross-checked with other publications. All specifications include state-level characteristics (proportion of Aid to Families with Dependent Children [AFDC] and Supplemental Nutrition Assistance Program [SNAP] recipients, poverty rate, an indicator for a Democratic governor, and the proportion of Democrats in state house and senate), demographic controls (gender, age, age squared), year fixed effects, and PUMA fixed effects. Standard errors in parentheses are clustered at the state level, and the critical values are generated using the wild bootstrap procedure. MW, minimum wage; PUMAs, Public Use Microdata Areas.

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.